Model for *Pinus nigra* Cataluña (Spain)

Model

Pnigra__cat__v01

Model description

- Specie: *Pinus nigra* J.F.Arnold
- Spanish Forest Inventory (SFI) code: 25
- Geographical area: Cataluña
- Geographical area (administrative): Gerona, Lleida, Barcelona and Tarragona

Figure 1: *Pinus nigra*, by Myrabella is licensed under CC BY-SA 4.0

Model type

- Category: growth
- Model level: distance independent individual tree model
- Reproduction methods: seedling forest
- Stand structure: even-aged stands
- Species composition: monospecific stands
- Forest origin: natural

Figure 2: Details of *Pinus nigra*, by https://antropocene.it

Model requirements and recommended use

- Initial inventory requirements: age and dominant height of the plot; expan and dbh of the trees. Aspect, slope and altitude are variables needed in order to calculate mushroom variables
- Geographical area: Cataluña, closer places and another places with similar characteristics (assuming differences)
- Stand type: monospecific stands
- Execution recommended time: 5 years executions (survival, growth and ingrowth equations developed by using that criteria)
- Site Index is defined as top height at a base age of 60 years

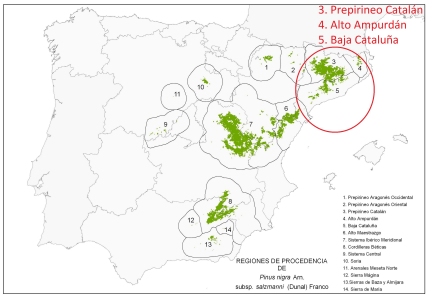
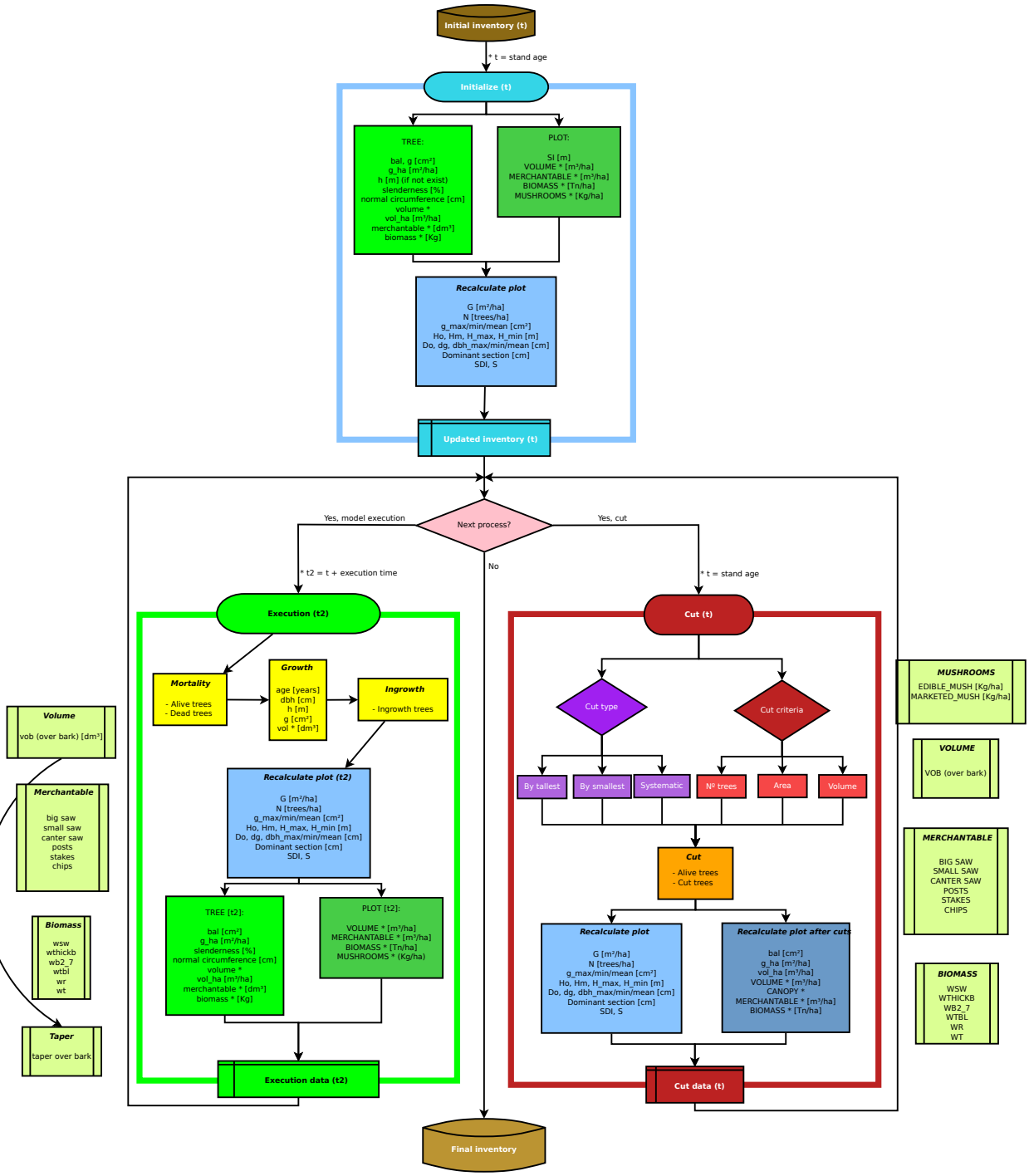


Figure 3: Provenance regions of *Pinus nigra* in Spain, by MAPA

Bibliography

Model components:

- **Site Index equations**:
  Palahí M, Grau JM (2003). Preliminary site index model and individual-tree growth and mortality models for black pine (Pinus nigra Arn.) in Catalonia (Spain). Forest Systems, 12(1), 137-148
- **Survival equation**:
  Palahí M, Grau JM (2003). Preliminary site index model and individual-tree growth and mortality models for black pine (Pinus nigra Arn.) in Catalonia (Spain). Forest Systems, 12(1), 137-148
- **Diameter growth equation**:
  Palahí M, Grau JM (2003). Preliminary site index model and individual-tree growth and mortality models for black pine (Pinus nigra Arn.) in Catalonia (Spain). Forest Systems, 12(1), 137-148
- **Ingrowth and distribution equation**:
  Trasobares, A., Pukkala, T., Miina, J. (2004). Growth and yield model for uneven-aged mixtures of Pinus sylvestris L. and Pinus nigra Arn. in Catalonia, north-east Spain. Annals of forest science, 61(1), 9-24.
- **General calculations: bal, g, slenderness, normal circumference**:
  Standard equations
- **Generalized height-diameter equation**:
  Palahí M, Grau JM (2003). Preliminary site index model and individual-tree growth and mortality models for black pine (Pinus nigra Arn.) in Catalonia (Spain). Forest Systems, 12(1), 137-148
- **Taper equations over bark (volume)**:
  Rodríguez F, Lizarralde I (2015). Comparison of stem taper equations for eight major tree species in the Spanish Plateau. Forest systems, 24(3), 2
- **Biomass equations**:
  Ruiz-Peinado R, del Rio M, Montero G (2011). New models for estimating the carbon sink capacity of Spanish softwood species. Forest Systems, 20(1), 176-188
- **Technological wood uses information**:
  Rodríguez F (2009). Cuantificación de productos forestales en la planificación forestal: Análisis de casos con cubiFOR. In Congresos Forestales
- **Value for Reineke Index equation**:
  Aguirre A, Condés S, del Río M (2017) Variación de las líneas de máxima densidad de las principales especies de pino a lo largo del gradiente estacional de la Península Ibérica. 7 Congreso Forestal Español
- **Edible and marketed mushrooms equations**:
  Palahí M, Pukkala T, Bonet JA, Colinas C, Fischer CR, Martínez de Aragón JR (2009). Effect of the inclusion of mushroom values on the optimal management of even-aged pine stands of Catalonia. Forest Science, 55(6), 503-511


Initial inventory (t)
* t = stand age
Initialize (t)
TREE:
bal, g [cm²]
g_ha [m²/ha]
h [m] (if not exist)
slenderness [%]
normal circumference [cm]
volume *
vol_ha [m³/ha]
merchantable * [dm³]
biomass * [Kg]
PLOT:
SI [m]
VOLUME * [m³/ha]
MERCHANTABLE * [m³/ha]
BIOMASS * [Tn/ha]
MUSHROOMS * [Kg/ha]
Recalculate plot
G [m²/ha]
N [trees/ha]
g_max/min/mean [cm²]
Ho, Hm, H_max, H_min [m]
Do, dg, dbh_max/min/mean [cm]
Dominant section [cm]
SDI, S
Updated inventory (t)
Next process?
Yes, model execution
Yes, cut
No
* t2 = t + execution time
* t = stand age
Execution (t2)
Mortality
- Alive trees
- Dead trees
Growth
age [years]
dbh [cm]
h [m]
g [cm²]
vol * [dm³]
Ingrowth
- Ingrowth trees
Recalculate plot (t2)
G [m²/ha]
N [trees/ha]
g_max/min/mean [cm²]
Ho, Hm, H_max, H_min [m]
Do, dg, dbh_max/min/mean [cm]
Dominant section [cm]
SDI, S
TREE [t2]:
bal [cm²]
g_ha [m²/ha]
slenderness [%]
normal circumference [cm]
volume *
vol_ha [m³/ha]
merchantable * [dm³]
biomass * [Kg]
PLOT [t2]:
VOLUME * [m³/ha]
MERCHANTABLE * [m³/ha]
BIOMASS * [Tn/ha]
MUSHROOMS * (Kg/ha)
Execution data (t2)
Volume
vob (over bark) [dm³]
Merchantable
big saw
small saw
canter saw
posts
stakes
chips
Biomass
wsw
wthickb
wb2_7
wtbl
wr
wt
Taper
taper over bark
Cut (t)
Cut type
Cut criteria
By tallest
By smallest
Systematic
Nº trees
Area
Volume
Cut
- Alive trees
- Cut trees
Recalculate plot
G [m²/ha]
N [trees/ha]
g_max/min/mean [cm²]
Ho, Hm, H_max, H_min [m]
Do, dg, dbh_max/min/mean [cm]
Dominant section [cm]
SDI, S
Recalculate plot after cuts
bal [cm²]
g_ha [m²/ha]
vol_ha [m³/ha]
VOLUME * [m³/ha]
CANOPY *
MERCHANTABLE * [m³/ha]
BIOMASS * [Tn/ha]
Cut data (t)
MUSHROOMS
EDIBLE_MUSH [Kg/ha]
MARKETED_MUSH [Kg/ha]
VOLUME
VOB (over bark)
MERCHANTABLE
BIG SAW
SMALL SAW
CANTER SAW
POSTS
STAKES
CHIPS
BIOMASS
WSW
WTHICKB
WB2_7
WTBL
WR
WT
Final inventory

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Interest Links

SiManFor: Support system for simulating Sustainable Forest Management Alternatives (2020) In: SiManFor. http://www.simanfor.es/. Accesed 15 May 2020

Sustainable Forest Management Research Institute UVa-INIA (iuFOR) (2020) In iuFOR. http://sostenible.palen Accesed 15 May 2020

Higher Technical School of Agricultural Engineering of Palencia. (2020) In: ETSIIAA Palencia. http://etsiiaa.uva.es/. Accesed 15 May 2020

University of Valladolid (UVa). (2020) In: UVa. http://www.uva.es/export/sites/uva/. Accesed 15 May 2020